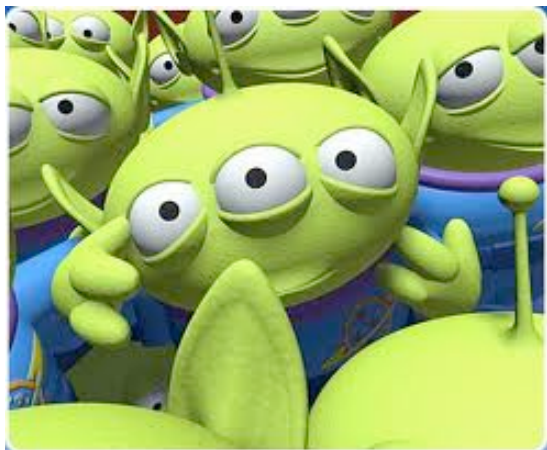


Patterns in Probability – Families on Zonk



On the Planet **Zonk**, there is a very strict set of rules regarding the size and make-up of families. Here are the rules:

1. Parents must keep having children until they have two consecutive children of the same gender. Then they must stop.
2. If consecutive boys or consecutive girls don't happen, then families must stop having children after 4 anyway.

[Assume that the probability of a Zonkian boy being born = 0.5, and the probability for a Zonkian girl is also 0.5 and that twins are **never** born].

A. Under these rules, what is the probability that a (fully-formed) family has:

- (i) No children
- (ii) 1 child
- (iii) 2 children
- (iv) 3 children
- (v) 4 children?

B. The Zonkian Government decides to change rule 2 – so the maximum family size is 5. Under these new rules, what is the probability that a (fully-formed) family has:

- (i) No children
- (ii) 1 child
- (iii) 2 children
- (iv) 3 children
- (v) 4 children
- (vi) 5 children?

C. The Zonkian Government decides to change rule 2 again – so the maximum family size is 6. Under these new rules, what is the probability that a (fully-formed) family has the maximum allowed number of children?

D. The Zonkian Government decides to change rule 2 again – so the maximum family size is N . Under these new rules, what is the probability that a (fully-formed) family has the maximum allowed number of children?

How did you get this answer?

How could you **prove** your answer is right?

E. What do you think the average number of children per family is when rule 2 says the maximum family size is 5? What about when the maximum family size is 7?

F. What do you think the average number of children per family is when rule 2 says the maximum family size is N ?

G. What if the probability of having a boy was only 0.4? Repeat Questions A through D with this value.